2.4.4 Kitchens

Kitchens offer excellent opportunities for achieving energy efficiency that are often largely overlooked. They are traditionally among the least energy-efficient operations in hotels. Large amounts of utilities are wasted, often due to lack of planning at the design stage and excessive use or poor practices. Equipment is turned on in the morning and may be left on for most of the day. Compared with private restaurants, hotel kitchens can use two to three times as much energy to provide the same quantity and quality of food. They can represent 15 per cent or more of the hotel's total energy consumption.

APPENDIX 3 shows how to assess energy consumption for kitchens, and gives benchmarks for comparison.

(a) KEY AREAS OF CONSUMPTION

The main areas where energy is used in hotel and restaurant kitchens are:

ELECTRICITY
TO POWER EQUIPMENT FOR REQUIREMENTS SUCH AS:

- chilled, frozen and ambient storage and ice-making machines
- cooking (ovens and hobs, microwaves, toasters, deep fat fryers, extractor fans)
- ware-washing (dishes, glasses, utensils, pots and pans)
- water boilers and coffee machines etc
- lighting
- food preparation and food service equipment (peelers, slicers, food processors and hot trolleys)
- waste disposal (waste disposal units, compactors and balers)

ENERGY USED FOR:

- cooking (ovens, grills and hobs may be fuelled by gas, oil, charcoal or electricity)
- hot water provision
- ventilation, filtration and extraction

(b) DESIGN AND GENERAL OPERATION

- The **design** of the kitchen and restaurant areas will have a major bearing on future operating costs, including space requirements, staffing, maintenance and energy use. Designing the throughput of the kitchen (and all its components) to match the anticipated demand will give the greatest energy efficiency.
- Consider whether the kitchen operation can be **centralised** or whether you can operate fewer kitchens for the same number of outlets. This may also help to reduce the number of staff required.
- Can specific cooking operations from different kitchens be **combined** in order to run less equipment?
- **Compare the cost** of electricity, gas and steam. Gas is often much cheaper than electricity, and in many countries there is an additional penalty for electric peak demand charges. Except for a very few cases, and depending on how the electricity is generated, gas will save about 80 per cent of carbon emissions and energy costs. There is also immediate availability of full heat with gas, so early start-up time is minimised.
- Where electricity is the only power option, investigate sources of **electricity generated by renewable sources** such as wind or solar power.
- Consider installing passive solar panels for **pre-heating** water or photovoltaic panels to produce some of the electricity to heat your water.
- Consider **diverting excess steam** generated from the hotel boilers to run electrical consuming items in the kitchen.
- The kitchen area should be **metered separately** from other departments for electricity, energy and water use so that consumption can be monitored over time and improvements made. In very large kitchens it is advisable to install individual meters on large power-consuming items.

- **Match equipment operation** to your needs. Use only the size of oven that is needed for the job. Use pots and pans of appropriate size for the heating element to prevent under-use. Do not heat up several heating elements if you need only one. An electric range burner should always be smaller than the pot placed on it. Place kettles or pots close together on large heating elements to reduce heat loss. Turn heat to lower levels once boiling point has been reached.
- **Never** place hot or warm food straight into cold rooms or chilling equipment.
- **Frozen food** should be defrosted in refrigerators or cold rooms with positive temperatures. Food will thaw more easily and help to reduce power demand for the refrigerator.

c MAINTENANCE

- Not only will regular routine **checks, maintenance and servicing** according to the manufacturers recommendations ensure that the equipment is operating for optimum energy efficiency, it will also improve safety and reduce problems such as equipment break-down and the inconvenience it can cause.
- Service all cooking appliances at least **twice a year** to ensure greater efficiency and safe operation.
- **Clean** grills and grease filters daily for greater heat transfer. This is also an important fire safety precaution.

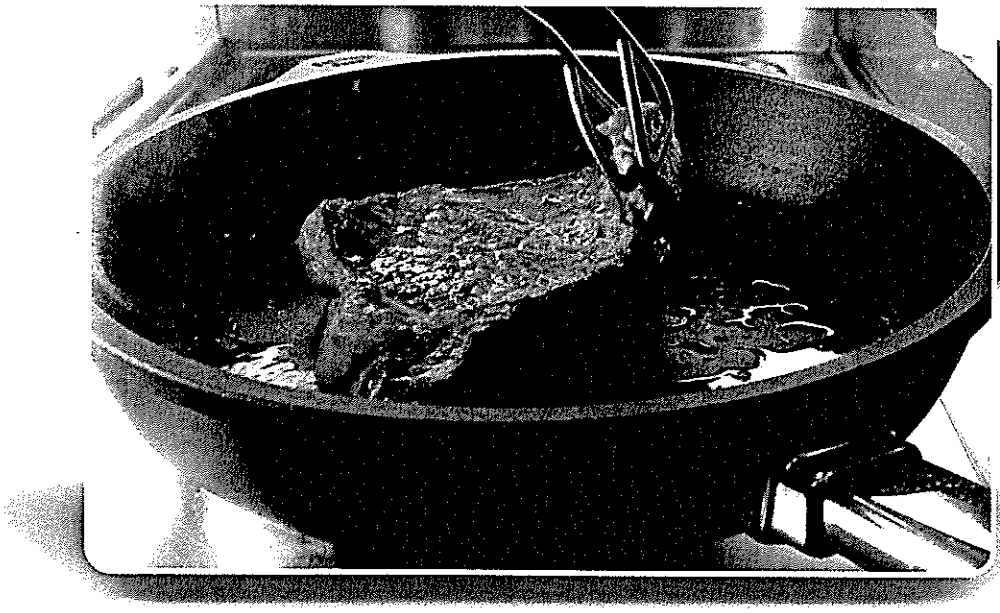
d CHILLED, FROZEN AND AMBIENT STORAGE

- Only the **minimum number** of refrigerators should be in operation at any one time. During periods of low occupancy, **consolidate** food storage and switch off units that are unlikely to be used for more than one month.
- **Walk-in chilled stores** usually consist of a chamber with a fan-assisted cooling unit near the door which should switch off automatically when the door is opened. The installation of a buzzer will alert staff to the fact that the door to the chilled store is open.
- When **receiving** frozen and pre-cooled goods, place them immediately into the appropriate storage to avoid warm-up and waste of energy for re-cooling. This is also a food hygiene requirement. Never put hot or warm food into cooling or freezing equipment.
- Keep the **frequency** of chiller and freezer **door openings** to a minimum. The air temperature in the unit can increase by as much as 0.5°C for every second the door is kept open. In older equipment, this will also lead to ice formation and lower energy efficiency. It will also create the need for more frequent defrosting – an energy-intensive operation that should be kept to a minimum.
- The entry of warm air into the cold store can be reduced by using a **plastic strip curtain**, or an air 'curtain' or blower over the door.
- To help prevent frequent door openings of walk-in chillers and freezers, consider installing a **daily working unit**. In this way, the main storage refrigeration need only be used when restocking the working fridge.
- All refrigeration equipment should be **well-insulated** to prevent heat loss or gain.
- **Defrost refrigeration appliances regularly** and check that **door seals** and **gaskets** on all equipment are working properly. Defrost in accordance with the manufacturer's instructions to ensure optimum performance and energy-efficiency.
- Check that **sensors and thermometers** are sited in the warmest part of the cabinet or chamber. Carry out air temperature checks at least once a day and keep records.
- **Storage units** are designed to maintain the temperature of pre-chilled foods and should not be used to chill them. Large volumes of food which are warmer than 4°C above the design temperature of the cabinet or cold room should be rapidly chilled in a purpose-built blast chiller before being placed in the storage cabinet.
- Situate exterior **ice making machines** and cold boxes for drinks under cover or in shaded areas. Automatic shut-down on ice-making equipment will save energy by stopping ice production when the storage bin is full.

- **Thaw food properly** prior to cooking. It takes 0.02kWh to heat one pound (454g) of minced beef from 4.5°C (its thawed temperature) to 60°C, whereas three times the amount of energy would be required to heat it from -18°C (its frozen temperature) to 60°C. Most hygiene regulations stipulate that all meats should be thoroughly defrosted before cooking for food safety reasons.
- Do not store items in front of evaporator coils and fans that will restrict **air circulation**.
- Keep coils free from **ice build-up**. The build up of ice could be due to a lack of refrigerant (caused by a leak), improperly set defrost cycles or overloading of the system through the doors being kept open or being poorly sealed.

(e) COOKING AND KEEPING FOOD WARM (OVENS, HOBS, GRIDDLES, MICROWAVES)

- Heating equipment should be **clustered together** and away from cooling equipment.
- Turn on cooking equipment **only when required** and switch it off, or at least turn it down, when no longer in use.
- Modern kitchen equipment takes a relatively short time to 'preheat' or come up to operating temperature. Adhere to the **manufacturer's recommendations** to avoid wasting energy. The speed by which the appliance achieves temperature will be affected by ambient temperatures and will differ for tropical and temperate climates.
- Ask staff to assess the **preheat periods** required on older equipment. Even with quite dated equipment, it is unlikely that preheat times will exceed 15 minutes. Once known, staff should be trained to turn all equipment on as required and lower the setting, or switch it off, when not required. Many older equipment models cannot easily be turned on and off so should be set to the lowest setting during periods of idleness, especially if the equipment has a large surface area.
- **Install timers** for cooking operations to shut off equipment automatically at pre-determined times.
- Consider, whenever possible, cooking at **lower temperatures**. In 1992, experiments in Canada proved that cooking meat for five hours at 121°C was up to 50% more energy-efficient than roasting it at 170°C. Cooking at the lower temperature also meant less shrinkage and therefore less loss of nutrients.
- Use a frying pan for a single customer rather than heating up an entire griddle and, where possible, use microwave cooking for **small tasks**, rather than heating up the oven.
- **Match the size** of the pan to the quantity of food to be cooked and choose the right-sized hob to fit the pan. Keep lids on wherever possible. Ensure good contact of pans (i.e. with a flat bottom) for maximum exposure to heat. Keep bottom of pots and pans clean and free from deposits and scale to facilitate good heat transfer.



Match the size of the pan to the quantity of food to be cooked and choose the right-sized hob burner/ring to fit the pan

- Where possible use **steam pressure cookers** – both cooking time and energy consumption are greatly reduced.
- In hard water areas, keep steam ovens, water boilers and kettles **free of lime scale** to ensure they operate efficiently.
- **Load and unload** ovens quickly to avoid unnecessary heat loss.
- **Check all burners** for uneven or yellow flames and adjust them.
- Consider **induction** cooking technologies when installing a new kitchen or refurbishing your existing one. To use induction hobs effectively, you may require new pans as aluminium pans cannot be used. The chef and cooking staff must also be fully trained to use the technology. Although the initial cost of the equipment will be higher, because energy is only used when the pans are placed on the hobs, the energy saved will soon pay for the investment.
- **Combination** (or combi) ovens may be an energy efficient option for some kitchens as they combine several cooking functions in one piece of equipment – dry heat (still or fan-driven) and steam which is injected into the oven when required. They can run off electric, mains gas and liquefied petroleum gas (LPG).
- Using an **'in-the-meat' thermometer** with a gauge outside the oven reduces the heat loss from opening the oven to check on cooking progress.
- **Warming tables** and lamps can be energy-intensive and their use should be kept to a minimum. They should only be pre-heated when required (as should be hot plates and bain-maries). Remember that this equipment is designed to keep hot food at the correct temperature and not to reheat cold food.

8 HOT WATER PROVISION

- Use hot water only when it is necessary to maintain **hygiene standards**.
- High efficiency **condensing boilers** are the most efficient. They can convert more than 88 per cent of the fuel used into heat, compared with around 80 per cent for conventional types. These boilers have either a larger or second heat exchanger which captures the heat that would normally escape up the flue from conventional boilers. This reduces the temperature of the flue gases to a point where water vapour produced during combustion is 'condensed out'. They can run on oil, gas and liquefied petroleum gas (LPG) and can operate either as combination boilers, to heat up hot water on demand, or as conventional system boilers, where a separate hot water cylinder is required.
- **Combination boilers** provide instant hot water for hand and equipment washing as required. By separating the hot water and heating systems they enable the heating system to be turned off or down without affecting the supply of hot water.
- Check to see if the amount of **stored hot water** can be reduced. Are there any storage tanks which can be valved-off or pipe runs which can be made shorter? Disconnect any hot water taps which are not required.
- Check **timers and circulation pumps**. If they are not working properly then they may be using more energy than necessary to provide hot water.
- Ensure hot water pipe-work is **well insulated**.

9 WARE-WASHING

- Try to run washers only when **full loads** can be processed and select the most economical programme for the job. When the main dishwashing rush is over, turn off the equipment and accumulate dishes until a full load is available or the next rush period occurs.
- Drying cycles on some dish-washers are very energy-intensive. Savings can be made by shortening **drying times** and using the **residual heat** from the machine instead.
- Where **steam** is available for the in-house laundry, use steam-heated (instead of electrical) exchangers for ware-washers.
- Use **softened water** in equipment to prevent the build-up of lime scale and to achieve optimum cleanliness and energy efficiency.
- Shut off the hot water booster for dishwashers and glass-washers automatically via a **solenoid valve** when the equipment is off. Ensure clean heat transfer surfaces.
- Install a **heat-recovery unit** on the dishwasher to recover energy from final rinse cycle.